

CLAIMS

1. A device for identifying a crank angle of an engine, comprising:
 - 5 crank angle signal detecting means that is supplied with a crank angle detecting signal for every predetermined angle and a crank angle detecting signal for every one rotation, based on a crankshaft synchronization rotating member that rotates in synchronization with a crankshaft;
 - 10 cam angle signal detecting means that is supplied with a cam angle detecting signal for every predetermined angle and a cam angle detecting signal for every one rotation, based on a camshaft synchronization rotating member that rotates in synchronization with a camshaft at a speed reducing ratio of 1/2 with respect to the crankshaft;
 - 15 first measuring means for measuring a generation time interval of the crank angle detecting signals obtained based on the crankshaft synchronization rotating member;
 - 20 second measuring means for measuring a generation time interval of the cam angle detecting signals obtained based on the camshaft synchronization rotating member;
 - 25 crank angle detecting signal determining means for comparing a generation time interval between the present and the previous crank angle detecting signals and a generation time interval between the previous and the previous before previous crank angle detecting signals measured by the first measuring means to determine whether the present crank angle detecting signal measured by the first measuring means is a crank angle detecting signal for every predetermined angle or a crank angle detecting signal for every one rotation;
 - 30 cam angle detecting signal determining means for comparing a generation time interval between the present and the previous cam angle detecting signals and a generation time interval between the previous and the previous before previous cam angle detecting signals measured by the second measuring means to determine whether the present cam angle detecting signal measured by the second measuring means is a cam angle detecting signal for every predetermined angle or a cam angle

detecting signal for every one rotation;

first signal set determining means for determining a signal set to be a first signal set when determination of the crank angle detecting signal determining means that the signal is a crank angle detecting

5 signal for every one rotation and determination of the cam angle detecting signal determining means that the signal is a cam angle detecting signal for every one rotation are performed within a predetermined angle;

second signal set determining means for determining a signal set 10 to be a second signal set when determination of the crank angle detecting signal determining means that the signal is a crank angle detecting signal for every one rotation and determination of the cam angle detecting signal determining means that the signal is a cam angle detecting signal for every predetermined angle are performed within a 15 predetermined angle; and

count reference determining means for determining a cylinder number corresponding to the first signal or the second signal, and also determining a generation point of the present crank angle detecting signal measured by the first measuring means to be a count reference of 20 the crank angle, when signal sets are determined by the first signal set determining means and the second signal set determining means to be the first, the second and the first signal set or the second, the first, and the second signal set sequentially in this order.

25 2. The device for identifying a crank angle of an engine according to claim 1, comprising:

first count reference provisionally determining means for provisionally determining a cylinder number corresponding to the first signal or the second signal and also provisionally determining a 30 generation point of the present crank angle detecting signal measured by the first measuring means to be a count reference, when an initial signal set is determined by the first signal set determining means and the second signal set determining means.

3. The device for identifying a crank angle of an engine according to claim 1 or 2, comprising:

crank angle signal counting means for counting the number of signal generations every time a crank angle detecting signal is generated; and

cylinder number update means for resetting the number of times of generation of detecting signals, and updating the cylinder number, when the number of times of generation of the crank angle detecting signal counted by the crank angle signal counting means reaches a predetermined value.

4. The device for identifying a crank angle of an engine according to claim 3, comprising:

additional condition considering means for determining as an additional condition whether or not the cylinder number and the number of generation of the crank angle detecting signals are those corresponding to the first or the second signal set when determining the next and following signal sets after the initial signal set has been determined by the first signal set determining means and the second signal set determining means.

5. The device for identifying a crank angle of an engine according to claim 3, comprising:

cylinder number crank angle detecting signal determining means for determining whether or not determination that the signal is a crank angle detecting signal for every one rotation has been obtained by the crank angle signal detecting determining means, when the cylinder number updated by the cylinder number update means is a predetermined number and the number of generation of the crank angle detecting signals counted by the counting means is a predetermined value.

6. The device for identifying a crank angle of an engine according to claim 1, comprising:

recording means for recording the number of times of consecutive determination of signal sets of the same number by the first signal set determining means and the second signal set determining means; and

5 recording number abnormality determining means for determining that abnormality has been reached, when the number of times of recording recorded by the recording means reaches a predetermined number of times.

7. The device for identifying a crank angle of an engine according to
10 claim 6, comprising:

signal set number reset means for resetting the number of times of consecutive determination of signal sets of the same number that is recorded in the recording means, when it is determined by the count reference determining means that a generation point of the present
15 crank angle detecting signal measured by the first measuring means is a count reference of the crank angle.

8. The device for identifying a crank angle of an engine according to
claim 1, comprising:

20 maximum time determining means for determining that a generation time interval of a cam angle detecting signal measured by the second measuring means that is a predetermined time or more is a maximum time; and

25 cam angle detecting signal invalid determining means for determining that the present cam angle detecting signal is invalid, when the generation time interval between the present and the previous cam angle detecting signals or the generation time interval between the previous and the previous before previous cam angle detecting signals measured by the second measuring means is determined to be the
30 maximum time by the maximum time determining means, regardless of the determination results of the cam angle detecting signal determining means as to whether the signal is a cam angle detecting signal for every predetermined angle or a cam angle detecting signal for every one rotation.

9. The device for identifying a crank angle of an engine according to claim 1, wherein

5 at least one of the crank angle detecting signal determining means and the cam angle detecting signal determining means is provided with abnormality determining means.

10. The device for identifying a crank angle of an engine according to claim 9, wherein

10 abnormality determination conditions for the abnormality determining means are based on a running state of an engine.

11. The device for identifying a crank angle of an engine according to claim 9, wherein

15 the abnormality determining means is provided in at least the crank angle detecting signal determining means, the abnormality determining means comprising control timing measuring means for measuring a time interval from a time when a cam angle detecting signal for every one rotation by the cam angle detecting signal determining 20 means to start of engine control; wherein

when it is determined by the abnormality determining means that abnormality has been reached, a time interval from determination of a cam angle detecting signal for every one rotation to start of engine control is measured by the control timing measuring means.

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12. The device for identifying a crank angle of an engine according to claim 9, wherein the abnormality determining means is provided in at least the crank angle detecting signal determining means,

comprising:

30 cam angle reference control timing measuring means for measuring a time interval from when a cam angle detecting signal for every predetermined angle or a cam angle detecting signal for every one rotation is determined by the cam angle detecting signal determining means to start of engine control;

cam angle detecting signal counting means for counting the number of times of signal generation every time a cam angle detecting signal is generated from when a cam angle detecting signal for every predetermined angle or a cam angle detecting signal for every one 5 rotation is determined by the cam angle detecting signal determining means; and

cam angle detecting signal resetting means for resetting the number of times of generation of cam angle detecting signals counted by the cam angle detecting signal counting means when a cam angle 10 detecting signal for every predetermined angle or a cam angle detecting signal for every one rotation is determined by the cam angle detecting signal determining means,

wherein when it is determined by the abnormality determining means that abnormality has been reached, engine control is performed 15 by the cam angle reference control timing measuring means.

13. The device for identifying a crank angle of an engine according to claim 9, wherein the abnormality determining means is provided in at least the cam angle detecting signal determining means,

20 comprising:

engine behavior determining means for determining behavior of an engine;

second count reference provisionally determining means for provisionally determining a cylinder number and determining that a 25 generation point of the present crank angle detecting signal is a count reference of the crank angle, when the present crank angle detecting signal measured by the first measuring means is determined to be a crank angle detecting signal for every one rotation by the crank angle detecting signal determining means; and

30 cylinder number·correct·or·not·determining means that continues engine control based on the crank angle detecting signal, and determines whether the cylinder number provisionally determined by the second count reference provisionally determining means is correct or not, based on the behavior of the engine determined by the engine behavior

determining means when it is determined by the abnormality determining means that abnormality has been reached.